

WHAT IS CLAIMED IS:

1 1. A method for reducing oxide contamination of a germanium substrate,
2 the method comprising:
3 positioning the germanium substrate in a process chamber;
4 generating a plasma from a treatment gas, the treatment gas comprising a flow
5 of a hydrogen-containing gas; and
6 providing the plasma to the process chamber to react with GeO₂ in the
7 germanium substrate.

1 2. The method recited in claim 1 wherein the plasma is generated
2 remotely from the process chamber.

1 3. The method recited in claim 1 wherein the plasma is generated in the
2 process chamber.

1 4. The method recited in claim 1 further comprising heating the
2 germanium substrate to a temperature less than about 550°C.

1 5. The method recited in claim 1 wherein the treatment gas further
2 comprises a flow of a diluent gas.

1 6. The method recited in claim 5 wherein the diluent gas comprises an
2 inert gas.

1 7. The method recited in claim 5 wherein the diluent gas comprises N₂.

1 8. The method recited in claim 1 wherein the hydrogen-containing gas
2 further contains nitrogen and does not contain silicon.

1 9. The method recited in claim 1 wherein the hydrogen-containing gas
2 comprises ammonia.

1 10. The method recited in claim 1 wherein the hydrogen-containing gas
2 comprises H₂.

1 11. The method recited in claim 1 further comprising generating a plasma
2 from a protective-layer gas that comprises a flow of a silicon-containing gas to deposit a

3 protective amorphous-silicon layer over the germanium substrate after reducing the oxide
4 contamination of the germanium substrate.

1 12. The method recited in claim 11 wherein generating the plasma from
2 the protective-layer gas comprises terminating the flow of the hydrogen-containing gas and
3 initiating the flow of the silicon-containing gas without terminating the plasma.

1 13. The method recited in claim 11 wherein generating the plasma from
2 the protective-layer gas comprises:
3 terminating the plasma from the treatment gas; and
4 thereafter, initiating the plasma from the protective-layer gas with the flow of
5 the silicon-containing gas.

1 14. The method recited in claim 11 further comprising depositing an oxide
2 layer over the protective amorphous-silicon layer.

1 15. The method recited in claim 14 wherein depositing the oxide layer is
2 performed with a plasma deposition process.

1 16. The method recited in claim 14 further comprising depositing a nitride
2 layer over the protective amorphous-silicon layer.

1 17. A method for forming an oxide layer over a germanium substrate, the
2 method comprising:

3 positioning the germanium substrate in a process chamber;
4 generating a first plasma from a treatment gas, the treatment gas comprising a
5 flow of ammonia;

6 providing the first plasma to the process chamber to react with GeO_2 in the
7 germanium substrate;

8 thereafter, generating a second plasma from a protective-layer gas that
9 comprises a flow of silane and providing the second plasma to the process chamber to deposit
10 a protective amorphous-silicon layer over the germanium substrate; and

11 thereafter, depositing the oxide layer over the protective amorphous-silicon
12 layer.

1 18. The method recited in claim 17 further comprising heating the
2 germanium substrate to a temperature between 350 and 550 °C while providing the first
3 plasma to the process chamber.

1 19. The method recited in claim 17 wherein the treatment gas further
2 comprises a diluent flow of an inert gas.

1 20. The method recited in claim 17 wherein the treatment gas further
2 comprises a diluent flow of N₂.

1 21. The method recited in claim 17 wherein generating the second plasma
2 is performed without terminating the first plasma.

1 22. The method recited in claim 17 further comprising terminating the first
2 plasma prior to generating the second plasma.